

Sub E IN THE CLAIMS:

1. (Amended Twice) A direct current sum bandgap voltage comparator comprising:

a summing node;

a plurality of current sources connected to the summing node, each current source further comprising at least one transistor, and each current source supplying a current to the summing node and being connected to a power supply voltage, wherein the currents sources supply currents according to a bandgap equation:

$$K_1 (V_{CC} - V_T) + K_1 V_T = K_2 V_{BE} + K_3 (kT/q)$$

where V_{CC} is the power supply voltage, V_T is the predetermined threshold voltage which defines the minimum acceptable voltage of V_{CC} , V_{BE} is a base emitter voltage defined by a selected transistor which comprises a current source within the plurality of current sources, and kT/q is equal to a thermal voltage where k is Boltzman's constant, T is the temperature in kelvin, q is the electronic charge, and K_1 , K_2 , and K_3 are constants; and

an indicator circuit having an input connected to the summing node and generating a logical signal at an output, responsive to voltage changes in the summing node.

Sub E 2
E 2 4. (Amended Twice) A direct current sum bandgap voltage comparator comprising:

3
4 a summing node;

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6 a plurality of current sources connected to the summing
7 node, each current source further comprising at least one
8 transistor, and each current source supplying a current to the
9 summing node and being connected to a power supply voltage; and

10
11 an indicator circuit having an input connected to the
12 summing node and generating a logical signal at an output,
13 responsive to voltage changes in the summing node, wherein the
14 currents sources supply currents according to a bandgap equation:

$$K_1(V_{CC}-V_T) + K_1V_T = K_2V_{BE} + K_3(kT/q)$$

15
16 where V_{CC} is the power supply voltage, V_T is the predetermined
17 threshold voltage which defines the minimum acceptable voltage
18 of V_{CC} , V_{BE} is a base emitter voltage defined by a selected
19 transistor which comprises a current source within the plurality
20 of current sources, and kT/q is equal to a thermal voltage where
21 k is Boltzman's constant, T is the temperature in kelvin, q is
22 the electronic charge, and K_1 , K_2 , and K_3 are constants and
23 wherein the plurality of current sources comprises four current
24 mirrors.

25
26 8/8. (Amended Twice) The direct current sum bandgap voltage
27 comparator of claim 7 further comprising a clamping circuit
28 connected to the summing node, wherein a voltage swing for the
29 summing node, responsive to changes in current supplied by the
30 current mirrors, may be set between [selected] predetermined
31 voltages.

32 C/9
33 10. (Amended Twice) The direct current sum bandgap voltage
34 comparator of claim 7 further comprising a cascode stage having
35 at least a first and second connections, the first connection is
36 connected to the summing node and the second connection is
37 connected to one of the four current mirrors. [located between
38 the summing node and the current mirrors.]

Sub E₂¹³

14. (Amended Twice) A zero power circuit comprising:

a first circuit;

a direct current sum bandgap voltage comparator comprising:

a summing node;

a plurality of current sources connected to the summing node, each current source further comprising at least one transistor, and each current source supplying a current to the summing node and being connected to a power supply voltage, wherein the current sources supply according to a bandgap equation:

$$K_1(V_{CC}-V_T) + K_1V_T = K_2V_{BE} + K_3(kT/q)$$

where V_{CC} is the power supply voltage, V_T is the predetermined threshold voltage which defines the minimum acceptable voltage of V_{CC} , V_{BE} is a base emitter voltage defined by a selected transistor which comprises a current source within the plurality of current sources, and kT/q is equal to the thermal voltage, where k is Boltzman's constant, T is the temperature in kelvin, q is the electronic charge, and K_1 , K_2 , and K_3 , are constants[.]; [and]

an indicator circuit having an input connected to the summing node and generating a logical signal at an output, responsive to changes in the summing node; and

a switching circuit for providing power to the first circuit from a primary power supply and a secondary power supply, the switching circuit being connected to the output of the indicator circuit, wherein power from the primary power supply is supplied to the first circuit if the logical signal indicates that the power supply voltage is equal to or greater than the predetermined threshold voltage [preselected voltage] and power from the secondary power supply is supplied to the first circuit if the power supply voltage is less than the predetermined threshold voltage [preselected voltage].

Sub E₂ 17. (Amended Twice) A zero power circuit comprising:

3 a first circuit;

4
5 a direct current sum bandgap voltage comparator comprising:

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7 a summing node;

8
9 a plurality of current sources connected to the summing
10 node, each current source further comprising at least one
11 transistor, and each current source supplying a current to the
12 summing node and being connected to a power supply voltage[-];
13 [and]

14
15 an indicator circuit having an input connected to the
16 summing node and generating a logical signal at an output,
17 responsive to changes in the summing node; and

18
19 a switching circuit for providing power to the first circuit
20 from a primary power supply and a secondary power supply, the
21 switching circuit being connected to the output of the indicator
22 circuit, wherein power from the primary power supply is supplied
23 to the first circuit if the logical signal indicates that the
24 power supply voltage is equal to or greater than the preselected
25 voltage and power from the secondary power supply is supplied to
26 the first circuit if the power supply voltage is less than the
27 preselected voltage, wherein the current sources supply according
28 to a bandgap equation:

$$K_1 (V_{CC} - V_T) + K_1 V_T = K_2 V_{BE} + K_3 (kT/q)$$

29
30 where V_{CC} is the power supply voltage, V_T is the predetermined
31 threshold voltage which defines the minimum acceptable voltage
32 of V_{CC} , V_{BE} is a base emitter voltage defined by a selected
33 transistor which comprises a current source within the plurality
34 of current sources, and kT/q is equal to the thermal voltage,
35 where k is Boltzman's constant, T is the temperature in kelvin,
36 q is the electronic charge, and K_1 , K_2 , and K_3 , are constants and
37 wherein the plurality of current sources comprises four current
38 mirrors.

1 27. (Amended) A direct current sum bandgap voltage comparator
2 comprising:

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4 a power supply having a predetermined threshold voltage
5 level which defines the minimum acceptable voltage level of the
6 power supply;

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8 a summing node;

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10 a plurality of current sources connected to the summing node
11 and directly connected to a power supply voltage, each current
12 source further comprising at least one transistor, and each
13 current source supplying a current to the summing node[, wherein
14 the summing node voltage level is responsive to the currents
15 supplied]; and

16
17 an indicator circuit having an input connected to the
18 summing node, wherein the indicator circuit is responsive to
19 changes in the summing node voltage level and generates at an
20 output a logical signal at one state when the summing node
21 voltage level is greater than [a] the predetermined threshold
22 voltage level [value] and generates the logical signal at the
23 output at another state when the summing node voltage level is
24 less than the predetermined threshold voltage level [value, the
25 predetermined value corresponding to a preselected power supply
26 voltage].

1 28. (Amended) The direct current sum bandgap voltage comparator
2 of claim 27, wherein the currents sources supply currents
3 according to a bandgap equation:

$$K_1(V_{CC}-V_T) + K_1 V_T = K_2 V_{BE} + K_3 (kT/q)$$

4
5 where Vcc is the power supply voltage, V_T is the predetermined
6 threshold voltage level, V_{BE} is a base emitter voltage defined by
7 a selected transistor which comprises a current source within the
8 plurality of current sources, and kT/q is equal to a thermal
9 voltage where k is Boltzman's constant, T is the temperature in
10 kelvin, q is the electronic charge, and K₁, K₂, and K₃ are
11 constants.

12
13 ~~2~~ 30. (Amended) The direct current sum bandgap voltage comparator
14 of claim 1 [3], wherein the plurality of current sources are
15 current mirrors.